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# A REVIEW OF THE HYLOBIUS OF NORTH AMERICA, WITH A NEW SPECIES INJURIOUS TO SLASH PINE (COLEOPTERA: CURCULIONIDAE)

By Rose Ella Warner[1]

Members of the weevil genus *Hylobius* are of economic importance because they damage trees. This review of the North American species brings together and summarizes information on their life histories and distribution from scattered sources. A new species from southeastern North America is described, and keys to males and females of the North American species are presented.

## *Hylobius aliradicis* Warner, NEW SPECIES (Figs. 37, 38, 48)

This species is closely related to *Hylobius rhizophagus* but differs in morphology and in some details of life history. I am describing this apparently native *Hylobius* from adults reared from larvae found in slash pine, *Pinus elliottii* Engelm. The larvae were found in tunnels in the roots of slash pine in the area of Homerville, Georgia, during the investigations into the cause of the poor condition and dying of slash pine. The reared specimens were submitted for identification by Mr. Bernard H. Ebel, U. S. Department of Agriculture Forest Sciences Laboratory, Athens, Georgia.

HOLOTYPE. Female. Length 10.4 mm.; body dark brown; coarsely punctured; tan setae distributed over the surface, patches of coarse setae more dense on pronotum, elytra, and laterally on visible abdominal sterna 2, 3, 4, and 5 and medially on sterna 3 and 4, scutellum covered with setae.

HEAD. Rostrum feebly arcuate, 0.9 mm. wide at apex, 0.8 mm. wide at base, 0.7 mm. wide in middle, 3.0 mm. long from apex to interocular fovea; densely punctured, punctures decreasing distally, large coalescing punctures forming shallow, lateral grooves in front of eyes, punctures of head large, separate; vestiture of rostrum from base anteriorly to antennal insertion of suberect, curved, tan setae, thicker, more abundant, and less curved next to eyes on sides of interocular fovea, from antennal insertion to apex with minute setae from each puncture, vertex with a patch of coarse setae; antennal segment 1 as long as next two combined (0.37 mm.), slightly more than twice as long as wide (0.37 mm.-0.16 mm.).

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THORAX. Pronotum in dorsal view wider than long (3.0-2.6 mm.); punctation dense, strigose on either side of a smooth median carina; vestiture of coarse, tan setae, setae coarser laterally, in a small patch medially each side of carina, and in front of scutellum. Prosternum with coarse, large punctures, apex of intercoxal process densely covered with appressed orangish, coarse setae; mesothoracic and metathoracic sterna and pleura coarsely punctured, each puncture with a coarse tan seta; intercoxal process of mesosternum elevated, apex pointed, densely covered with orange setae; scutellum densely covered with orange setae.

LEGS. Femora with large tooth, capped with a tuft of setae; each puncture with a seta; tibiae straight along dorsal border, ventral border sinuate and carinate near base, a row of setae on each side of carina; tarsi normal.

ELYTRA. Length 7.3 mm.; width at humeri 3.7 mm.; vestiture of fine and coarse setae, sutural interval flat, more finely punctured, other intervals coarsely punctured. Elytron at half length with coarse setae forming diagonal bars, one short, directed anteriorly toward suture and extending from interval 10 to 7, one long, directed posteriorly toward suture and extending from interval 7 to 2, one short, directed anteriorly toward suture and extending from intersection with long bar at interval 4 to 2; across declivity with broad, horizontal bar extending from interval 10 to 2, with smaller, short bar, directed anteriorly toward suture and extending from intersection with horizontal bar at interval 4 to 2. Bars which reach interval 2 form diamond at half length and triangle across top of declivity on middle of combined elytron. Elytra with scattered patches of setae between bars but not forming definite patterns.

ABDOMEN. 1st and 2nd visible abdominal sterna shiny, finely and sparsely punctate, posterior half of 2nd, all of 3rd, 4th, and 5th coriaceous, not as shiny, 5th coarsely densely punctured, laterally impressed. Each puncture with seta, setae broader, thicker, and forming patches on lateral margins of sterna 1-5 and medially on sterna 3 and 4.

TYPE LOCALITY. Homerville, Georgia, USA. Collected as larvae in the roots of young slash pine (*Pinus elliottii* Engelm.), October 23, 1964, by Bernard H. Ebel. Emerged November 9, 1964, USDA Forestry Sciences Laboratory, Athens, Georgia. U.S.N.M. type number 69023.

ALLOTYPE. Male. Slightly larger and more slender than holotype. Patches of setae on elytral intervals arranged in more exact bars with the diamond and triangular spaces more pronounced than in holotype. Rostrum stouter. First and 2nd visible abdominal sterna medially concave, 5th medially impressed with fine erect setae in the impressed area. Collected in Athens, Georgia, 10-19-43, by P. W. Fattig. This specimen was selected as the allotype rather than one from the reared material from which the holotype was selected because two males of that series are teneral, and one has the 5th visible abdominal sternum very convex before the impression. The three male specimens from a third series, Hopkins no. 45725, collected in 1961, were used in genetic studies before being submitted for identification and are in very poor condition.

PARATYPES. Three males, Homerville, Georgia, August 31, 1961, collected as larvae in roots of 4-year-old slash pine; reared at Olustee, Florida, November 25, 1961; Hopkins no. 45725. Two females collected near Homerville, Georgia, August 31, 1961, as larvae, B. H. Ebel, reared ex 2- to 4-year-old slash pine roots, November 29, 1961; Hopkins no. 45724. Five females and three males, Homerville, Georgia, October 23, 1964, B. H. Ebel, in roots of young slash pine, emerged November 4-9, 1964, at Athens, Georgia. One male, Olustee, Florida, Baker Co., April 4-10, in pine bolt trap with *H. pales*.

Other material examined includes specimens from the following localities: One female from fruit fly trap, 1953, C. L. Smith; one female, Florida [probably Valparaiso], Wakely, May 8, 1931, injurious to *Pinus palustris*

Mills. seedlings. [*Pinus palustris,* the name generally accepted for longleaf pine, is the name used by Small (1933) and others for slash pine]. One female, Hockly [sic], Texas, I. W. Thuron. Two females, Bolton, North Carolina, November 1965, by H. Laymen; Hopkins no. 50506-F.

*H. aliradicis* can be separated from the other Nearctic species of *Hylobius* by the characters in the key. Two characters, the shape of the 7th tergum and the arrangement of the stridulatory tubercles on the 7th tergum, not previously used in separating the species of *Hylobius,* are used here. Although the number of tubercles varies to a considerable degree and is unreliable for separating the species, the arrangement of the tubercles is of taxonomic value. Only in *pales* are the stridulatory tubercles arranged in two divergent lines and not intermingled with the dense split setae covering the tergum (fig. 5). The stridulatory ridges are very evident in *pales* and can be seen easily with low magnification. In *radicis, rhizophagus,* and *aliradicis* the stridulatory tubercles are intermixed with the vestiture of the 7th tergum and are not easily discernible. In *pales* and *congener* the posterior margin of the 7th tergum is retuse (figs. 5, 6); in *aliradicis* it is rounded (fig. 9); in *radicis* it is slightly retuse (fig. 7); and in *rhizophagus* it is truncated (fig. 8). A compound microscope was used to study the cleared 7th tergum mounted in glycerine.

## A Key to the Species of the Nearctic Hylobius (Males)

1. Femoral tooth well developed---------- 2
   Femoral tooth absent or inconspicuous ---------- 6
2. Scutellum glabrous or with a few fine setae; basal third of posterior surface[2] of metafemur medially carinated and grooved; ventral edge of protibia with a fringe of long white setae; apex of uncus of metatibia broadly rounded (fig. 1); stridulatory tubercles on 7th tergum prominent (fig. 6); median lobe of genitalia as figured (fig. 12); length 6.4-9.0 mm.----------CONGENER
   Scutellum covered with scale-like setae; metafemur not carinated and grooved; protibia without a fringe of long white setae; apex of uncus of metatibia broadly rounded or acute ---------- 3
3. Apex of uncus of metatibia broadly rounded; head usually with a patch or line of broad setae on vertex; punctures immediately behind interocular fovea coalescent, forming short, irregular rugae; stridulatory tubercles of 7th tergum in 2 very prominent divergent rows; posterior margin of 7th tergum retuse (fig. 5); median lobe of genitalia as figured (fig. 13); length 5.8-11.3 mm.----------PALES
   Apex of uncus of metatibia acute (figs. 2, 3, 4); head not usually with a patch or line of broad setae on vertex; punctures immediately behind interocular fovea separated; stridulatory tubercles on 7th tergum not immediately evident; posterior margin of 7th tergum retuse or not---------- 4
4. Body dull reddish brown; vestiture of fine setae; elytra with irregularly placed spots of yellow setae, better developed on even intervals and rarely forming submedian or subapical bars, the general effect tessellate; lateral setae on visible abdominal sterna 1-2 diffused, not condensed into spot; stridulatory tubercles in 2 broken lines; posterior margin of 7th tergum slightly retuse (fig. 17); median lobe of genitalia as figured (fig. 14); length 9.7-12.0 mm.----------RADICIS
   Body black or piceous---------- 5
5. Body shining black; antennae and tarsi brown; white setae distributed on surface, with dense patches scattered over dorsal surface of elytra, fine setae below interocular fovea suberect; stridulatory tubercles usually in 2 broken lines; posterior margin of 7th tergum more or less truncate (fig. 8); median lobe of genitalia as figured (fig. 15); length 8.9-10.0 mm.----------RHIZOPHAGUS

[2] In all previous keys this surface has wrongly been referred to as the anterior surface.

Body piceous; elytra with regularly placed spots of coarse yellow setae forming 2 prominent bars, one diagonal, directed posteriorly toward suture and extending from interval 7 to 2, a broad horizontal one across declivity extending from interval 10 to 2, stridulatory tubercles in 2 broken lines; posterior margin of 7th tergum rounded (fig. 9); median lobe of genitalia as figured (fig. 16); length 8.7-11.4 mm. ----------ALIRADICIS

6. Femoral tooth absent or inconspicuous; rostrum rather stout, less than 2.6 times as long as wide, noticeably wider distally; apical umbones of elytra obscure or entirely undefined; body color very dark brown to blackish, with white to pale yellow slender setae forming irregular small spots on elytra; median depression of visible abdominal sterna 1-2 large, deep; metathoracic wings very short, not extending beyond the posterior margin of the first visible abdominal sternum; median lobe of genitalia as figured (fig. 10); length 12.5-13.5 mm.--------WARRENI

Femoral tooth small but distinct; rostrum slender, more than 2.9 times as long as wide, not wider distally; apical umbones of elytra prominent; body color appears grayish, with indefinite, almost confluent patches of white or yellowish spots of slender setae on elytra; median depression of visible abdominal sterna 1-2 small, shallow; metathoracic wings long, extending well beyond elytral apex, median lobe of genitalia as figured (fig. 11); length 10.7-13.2 mm.--------PINICOLA

## A Key to the Species of Nearctic Hylobius (Females)

1. Femoral tooth well developed---------- 2
   Femoral tooth absent or inconspicuous---------- 6
2. Scutellum glabrous or with a few fine setae; basal third of posterior surface of metafemur carinate and grooved; spermatheca and 8th sternum as figured (figs. 22, 26); length, 6.5-9.4 mm. ----------CONGENER
   Scutellum covered with scale-like setae; metafemur not carinate and grooved------ 3
3. Body black, antennae and tarsi dark brown; fine white setae distributed over surface, with dense patches scattered irregularly over dorsal surface of elytra; pronotum with median smooth carina on anterior three-fourths; very fine white setae present in most of the punctures; patches of coarser setae on both sides of carina and mediolaterally on sides of prothorax; spermatheca and 8th sternum as figured (figs. 23, 29); length, 9.8-11.6 mm.----------RHIZOPHAGUS
   Body brown or piceous ---------- 4
4. Body brown; vestiture fine, elytra with irregularly placed spots of pale yellow setae, better developed on even intervals and rarely forming submedian or subapical bars, the general effect tessellate; lateral setae on visible abdominal sterna diffused, usually not condensed into spots; spermatheca and 8th sternum as figured (figs. 19, 30); length, 9.5-12.5 mm. ----------RADICIS
   Body piceous ---------- 5
5. Rostrum slender, 2.6 mm., very little wider beyond antennal insertion; punctures immediately behind interocular fovea separated; rostral setae white, conspicuous, dense, suberect; spermatheca and 8th sternum as figured (figs. 17, 28); length, 9.5-12.8 mm. ----------ALIRADICIS
   Rostrum stout, 2.1 mm., noticeably wider beyond antennal insertion; punctures immediately behind interocular fovea coalescent, forming short, irregular rugae; rostral setae brownish, not very conspicuous, fine (sometimes coarser near interocular fovea), sparse, not erect; spermatheca and 8th sternum as figured (figs. 21, 27); length, 7.4-10.3 mm.----------PALES
6. Apical umbones of elytra obscure to entirely undefined; body color very dark brown to blackish, white to pale yellow setae forming irregular small spots on elytra; spermatheca and 8th sternum as figured (figs. 20, 24); length, 12.0-15.1 mm. WARRENI
   Apical umbones of elytra prominent; body color appears grayish, with indefinite, almost confluent patches of white or yellow spots of slender setae; spermatheca and 8th sternum as figured (figs. 18, 25); length, 11.0-14.5 mm.----------PINICOLA

Because three species that attack root systems, *radicis, rhizophagus,* and *aliradicis,* are so similar, the following table (table 1) of contrasting biological data will be helpful in separating those species.

TABLE 1. CONTRASTING BIOLOGICAL HABITS OF THREE MORPHOLOGICALLY SIMILAR SPECIES OF HYLOBIUS THAT ATTACK ROOT SYSTEMS

| *radicis*[3] | *rhizophagus*[3] | *aliradicis*[4] |
|---|---|---|
| 1. Larvae tunnel in bark and cambium of root collar region; pupation occurs in nearby soil. Larvae found not more than 12 inches from root collar. | 1. Larvae tunnel in roots from smaller end towards base, usually found in roots under half inch in diameter; pupation occurs in pupal cells in the roots. | 1. Larvae tunnel in both lateral roots and the outer part of the upper tap root, completely boring the smaller roots and more or less spiraling around the larger ones; pupation occurs in cells in the roots, often in the upper tap root area under the bark. |
| 2. Activity of insect causes abundant resin flow and root collar is surrounded with pitch-infiltrated, blackened soil. | 2. Activity of insect results in very light resin flow which rarely saturates soil more than one inch away. | 2. Activity of the insect results in moderate resin flow which causes the soil to adhere loosely in the infested roots. |
| 3. Adult oviposition in or on bark in root collar region. | 3. Adult oviposition site not known, but circumstantial evidence suggests the region of the root tips. | 3. Oviposition site unknown; association of infestation with pine roots in loose soil suggests the upper tap root area as a logical oviposition site. |
| 4. Infests primarily open-growing, young pines. Trees over 1 inch in diameter at ground line are susceptible to attack. | 4. Infests primarily closed plantations of pole-sized pines on formerly cultivated land. In advanced infestations, reproduction pines may also be infested. | 4. Infests young pines, pencil-sized to about 2 inches in root collar diameter; associated with young pines growing in loose soil. |

## *Hylobius pales* (Herbst)
## (FIGS. 34, 41)

*Curculio pales* Herbst. 1797. Natursyst. Ins. Käf. 7:31.

The species *pales,* the pales weevil, has been reported feeding on a number of pines (*Pinus*)[5] including white pine (*P. strobus* L.), pitch pine (*P. rigidia* Mill.), ponderosa pine (*P. ponderosa* Laws.), mugho pine (*P. mugo* Turra.), Mexican pinyon pine (*P. cembroides* Zucc.), Scotch pine (*P. sylvestris* L.), red pine (*P. resinosa* Ait.), loblolly pine (*P. taeda* L.), shortleaf pine (*P. echinata* Mill.), longleaf pine (*P. palustris* Mill.), Austrian pine (*P. nigra* Arn.), and jack pine (*P. banksiana* Lamb.). White pine is the preferred host plant. White pine, pitch pine, ponderosa pine, mugho pine, and Mexican pinyon pine have been named specifically as probable hosts of the immature stages (Peirson, 1937; Wells, 1926). In southern Ontario, Canada, adults were reared from red, jack, scotch, and white pine (Finnegan, 1959). Other conifers listed as hosts are tamarack (*Larix laricina* (Du Roi) Koch), balsam fir (*Abies balsamea* (L.) Mill.), red spruce (*Picea rubra* (Du Roi) Dietr.), Nor-

[3] Millers, Benjamin, and Warner, 1963.
[4] Ebel, personal communication, subject to modification by more detailed observation.
[5] All scientific and common names of the host trees were checked in Little (1953).

way spruce (*P. abies* (L.) Karst.), eastern hemlock (*Tsuga canadensis* (L.) Carr.), Douglas fir (*Pseudotsuga menziesii* (Mirb.) Franco), eastern red cedar (*Juniperus virginiana* L.), common juniper (*J. communis* L.), Arizona cypress (*Cupressus arizonica* Green), northern white-cedar (*arborvitae*) (*Thuja occidentalis* L.), as well as gray birch (*Betula alleghaniensis* Britton) and white ash (*Fraxinus americana* L.) (Carter, 1916; Peirson, 1921).

The adults hibernate beneath stones, in litter, or in soil at the base of the seedlings, becoming active, depending on the locality and altitude, from April to June, during which time they feed on the tender bark of the twigs of saplings and at the base of seedlings. The eggs are laid singly, in the inner bark of freshly cut pine logs or the roots of freshly cut pine stumps. They hatch in about two weeks. Larvae feed for about two weeks in the cambial area of the roots and stumps. They pupate in "chip cocoons" constructed in the stump lying below the surface and in the root system where roots are over one-quarter of an inch in diameter. The new adults emerge in about a month, and it is at this time they feed on the pine seedlings. *H. pales* is typically a nocturnal feeder. The susceptibility of the young seedlings seems to depend upon the nature of the bark, those seedlings having relative thin, tender bark, being favored for food. Injury likely to cause death is confined to trees under three feet in height. In southern Ontario, Canada, *H. pales* is associated mostly with Christmas tree plantations where selective cutting is practiced and a continuous supply of breeding material is available. (Beal and McClintock, 1943; Carter, 1916; Finnegan, 1959; Peirson, 1921; and Wells, 1926).

DISTRIBUTION[6] (fig. 45): *Hylobius pales* is found in most of the eastern half of the United States from Maine to Florida and west to Texas and in Canada from Nova Scotia to Manitoba. MAINE: Cumberland Co.; Kittery Point; Mt. Katahdin, Camp Kennedy. NEW HAMPSHIRE: Canbie Lake; Durham; White Mts.; Webster; Manchester. CONNECTICUT: Stamford. VERMONT: Brattleboro. MASSACHUSETTS: Springfield; Cambridge; Chicopee; Petersham; Berlin; Stoughton; Hummerock; Tynsboro; North Saugus; Ipswich; Marshfield; Framington. RHODE ISLAND: Watch Hill. NEW YORK: Bellport; Long Island; Greenwood Lake; Cranberry Lake; West Point; Haverhill; Islip; Buffalo; Ithaca; Albany; Ballston Spa. NEW JERSEY: Malaga; Seaside Hts.; Greenwood Lake; Lakehurst; Newark; Ocean City; Orange; Barnegat; Bayhead; New Lisbon; Rancocas Park; Whitesbag. MARYLAND: Beltsville; Berwyn Heights; Piney Point; Bladensburg; Hagerstown; Hyattsville; Plum Point; Plummers Island; Bethesda; Branchville. WEST VIRGINIA: Driscoll; White Sulphur Springs; Kanawha Station. VIRGINIA: Mount Vernon; Falls Church; Rosslyn; Warrenton; Chester; Nelson Co.; St. Elmo; Maywood; Bostin; Bland Co.; King and Queen Co.; Ft. Monroe; Herndon. NORTH CAROLINA: Durham; Southern Pines; Ellenboro; Tyron; Biltmore; Atkinson; Mount Mitchell; Black Mts.; Asheville; Raleigh; Roundtop; Pisgah Ridge; Pink Beds; Beaufort. GEORGIA: Clayton; Miller; Richmond Hill; Thomasville; Homerville. SOUTH CAROLINA: Myrtle Beach; Florence; Fort Mill; Clemson. FLORIDA: Palatka; St. Nicholas; Orange Co.; Lake City; Foley; Villa Tassa; Key West; Olustee, Baker Co.; Valparaiso. ALABAMA: Birmingham; Montgomery; Lamar; Lasca; Mobile; Jena. LOUISIANA: Bogalusa; Hodge; Sardis. MISSISSIPPI: Saucier; Meridian; Gulfport; Paris; Durant; A&M College. ARKANSAS: Crossett; Benton; Hot Springs; Star City; Kingsland. TEXAS: Call; Deweyville; Nacogdoches. MISSOURI:

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[6] From specimens in the Canadian National Collection and the United States National Museum Collection unless otherwise stated.

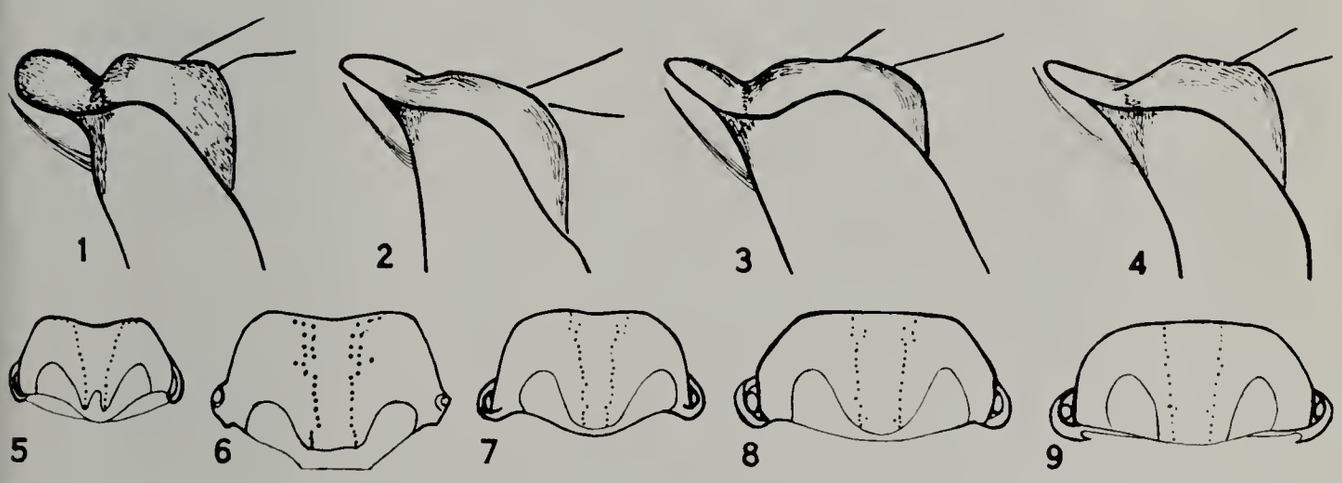
St. Louis. WISCONSIN: Sparta; Cranmoor, Wood Co. OHIO: Hocking Co. MICHIGAN: Port Huron. MINNESOTA: Bemidji; Itasca Park; Collegeville. PENNSYLVANIA: State College; Morrisville; Glenside; Lehigh Gap; Holiday; Twin Lakes; Monroe Co. DISTRICT OF COLUMBIA: Rock Creek [Park]. CANADA. QUEBEC: Norway Bay; Ft. Coulonge; Covey Hill; Montreal; Wright. ONTARIO: Marmora; Petawawa; Go Home Bay; Maple; Kerr Lake; now occurring (Finnegan, 1959) in epidemic numbers in Simcoe Co., Durham Co., and generally in the area west of a line drawn through Port Severn and Trenton; Ottawa; Constance Lake; Grand Bend; Mount Hope.

## *Hylobius pinicola* (Couper)
## (Fig. 32)

*Curculio pinicola* Couper, 1864. Trans. Lit. Hist. Soc. Quebec, n.s. 2:65.

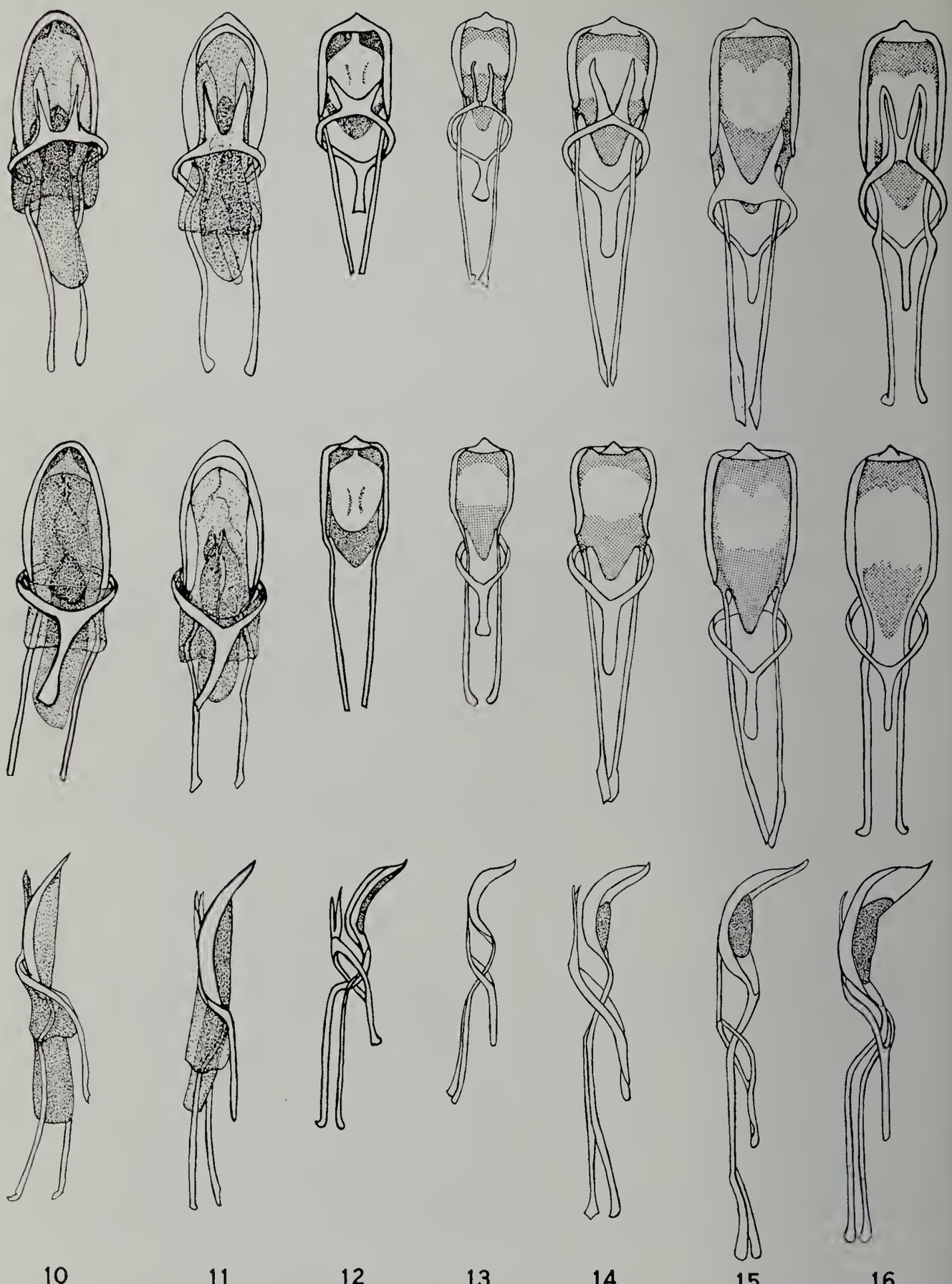
Larvae of this species attack the root systems of most coniferous trees, including members of the genera *Pinus, Abies,* and *Larix,* specifically tamarack (eastern larch) (*Larix laricina* (DuRoi) K. Koch) and white spruce (*Picea glauca* (Moench) Voss) when they occur on moist to wet sites. (Wood, 1957; Warren, 1960).

DISTRIBUTION[6] (fig. 43): CANADA: NEWFOUNDLAND: St. John; Port au Basque. LABRADOR: Cartwright; George River. NEW BRUNSWICK: Bathurst. QUEBEC: Percé; Natashquan; Little Mecatina Is.; Knob Lake; Chicoutimi; Montmorency; Gaspé; Trinity Bay; Abitibi; Great Whale River; Cascapedia. ONTARIO: Petawawa; Stittsville; Sudbury. MANITOBA: Awame; Churchill; Onah. SASKATCHEWAN: Prince Albert; Christopher Lake; Dorentosh. ALBERTA: Mitsue. BRITISH COLUMBIA: Dome Creek. YUKON TERRITORY: Swin Lakes. UNITED STATES: MAINE: East Branch; Center Mt.; Chesuncook; Kennedy Camp, Mt. Katahdin. VERMONT: Mt. Mansfield. NEW HAMPSHIRE: Carter Dome, White Mts. NEW YORK: White Face Mt. Trail; Top of Slide Mountain, Ulster Co.; Mt. Marcy; Ithaca. MICHIGAN: Marquette; Grand Isle; Seney. WISCONSIN: Cranmoor, Wood Co.; Mamie Lake. NORTH CAROLINA: Mount Mitchell, Black Mts.




Figures 1-4, *Hylobius* spp., metatibial unci of males. 1—*congener* and *pales*. 2—*radicis*. 3—*rhizophagus*. 4—*aliradicis*.

Figures 5-9, *Hylobius* spp., dorsal view of 7th tergum of males. Dotted lines represent arrangement of stridulatory tubercles. 5—*pales*. 6—*congener*. 7—*radicis*. 8—*rhizophagus*. 9—*aliradicis*.




FIGURES 10-16, *Hylobius* spp., median lobe of male genitalia, top row, dorsal view; middle row, ventral view; bottom row, lateral view. 10—*warreni*. 11—*pinicola*. 12—*congener*. 13—*pales*. 14—*radicis*. 15—*rhizophagus*. 16—*aliradicis*.

## *Hylobius congener* Dalla Torre, Schenkling, and Marshall (Fig. 33)

*Hylobius congener* Dalla Torre, Schenkling, and Marshall, 1932. Coleopterorum Catalogus, pars 122:15.

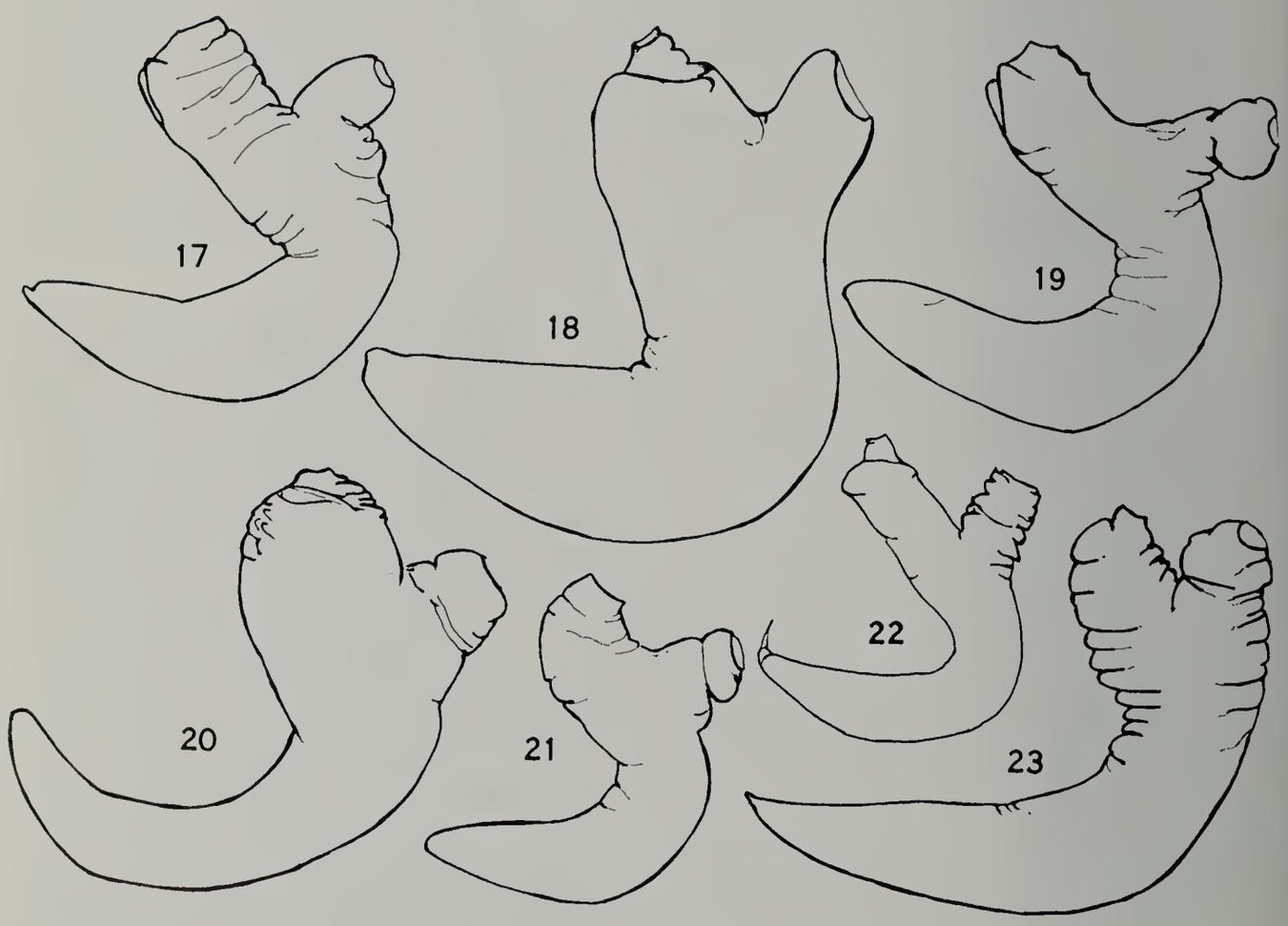
Hosts: Red pine (*Pinus resinosa* Ait.), white pine (*P. strobus* L.), and Scotch pine (*P. sylvestris* L.). The following is from Martin (1964). The adults deposit their eggs singly in the shallow cavities excavated in the bark of logs and stumps, usually at the margin of branch or mechanical scars and often at the end of logs. The entrances to the cavities are filled with bark chips and frass. Oviposition begins during the last week of May and continues into June. The eggs hatch in about 10 days. Newly hatched larvae excavate small irregular cavities in the bark at the oviposition site. Second instar larvae begin more or less regular tunnels following the grain of the wood. Feeding is restricted to the phloem, and brown frass fills the tunnel behind the larvae. The larvae reach maturity in about 65 to 70 days. After feeding is completed, the larvae begin to excavate pupal pits. They tear out coarse wood chips and make short tunnels, about 5 mm. in depth, at right angles to the surface of the wood. At this depth, the larvae turn at right angles again and excavate their pupal cells parallel to, but several millimeters below, the surface of the wood. The wood chips are packed with frass in the old feeding tunnels. The larvae enter the prepupal stage from mid-August until late September and remain in this stage throughout the winter. After emergence from the pupal cells during late July and August, the adults feed on the inner bark of logs and slash. After feeding intermittently for several weeks, they enter the duff and overwinter. The weevils come out of the litter the following spring about mid-May and resume feeding. A flight period of one to two weeks occurs at this time. Following the flight period, breeding begins, and the adults adopt a nocturnal habit and travel mostly by crawling on the ground.

DISTRIBUTION[6] (fig. 44): CANADA: LABRADOR: Goose Bay. NEWFOUNDLAND: Gander; Corner Brook. NOVA SCOTIA: Kentville; South Ohio; Yarmouth; Dartmouth; Beaver Bank; Wayerley; Grosses Goques; Halifax; Parrsboro; Pt. Maitland. NEW BRUNSWICK: French Lake; New Castle; Bathurst; Tabusintac. QUEBEC: Duparquet; Ft. Coulonge; Indian House Lake; Hemmingford; Mistassini Lake; Seven Isle; Mt. Laval; Wright; Cascapedia; Gaspé; Forestville; Knob Lake; Laniel; Bradore Bay; Natashquan; Trinity Bay; Thunder River; Duchesnay; Ile Montreal; Mt. St. Hilaire; Great Whale River; Aylmer. ONTARIO: One Side Lake; Ojibway; Ottawa; Arnprior; Constance Bay; Kerr Lake; Dryden; Petawawa; Ogoki; Sudbury; Frater; Trentor; Algoma District (Martin, 1962). MANITOBA: The Pas; Makinak; Rennie; Riverton; Pine Falls. SASKATCHEWAN: Prince Albert. ALBERTA: McMurray; Edmonton. BRITISH COLUMBIA: Inverness; Massett, Queen Charlotte Island; Vancouver; Trinity Valley. NORTHWEST TERRITORIES: Fort Smith. UNITED STATES: MAINE: Passadunkeag; Cumberland Co. NEW HAMPSHIRE: Pike; White Mts.; Rumney; Hampton; Mt. Washington. VERMONT: Brattleboro. RHODE ISLAND: Watch Hill. MASSACHUSETTS: East Otis; Framington; Ipswich. NEW YORK: Cranberry Lake; Peru, Clinton Co.; Buffalo; Ithaca; Greene Co. NEW JERSEY: Menantico; Newark. MICHIGAN: Agri. College; Marquette; Port Huron; Escanaba; Eagle Harbor; Michipicten. WISCONSIN: Oshkosh; Apostle Island; Lake St. Germaine; Bayfield; Iron River. MINNESOTA: Lake Itasca Park; Two Harbors; Duluth; Little Winnebegosish. ALASKA: Ft. Wrangle. NORTH CAROLINA: Mt. Guyot, Great Smoky Mts.

## *Hylobius radicis* Buchanan
(Figs 35,40)

*Hylobius radicis* Buchanan, 1935. Proc. Ent. Soc. Wash. 36(8-9) 1934 [1935]:252

The species *radicis,* the pine root-collar weevil, attacks the root crown of living Scotch pine (*Pinus sylvestris* L.), Austrian pine (*P. nigra* Arn.), lodgepole pine (*P. contorta* Dougl.), Corsican pine (*P. nigra poiretiana* Schneid), eastern white pine (*P. strobus* L.), Mugho pine (*P. mugo* Turra.), jack pine (*P. banksiana* Lamb.), pitch pine (*P. rigida* Mill.), and red pine (*P. resinosa* Ait.). The adults that hibernate resume activity early in the spring. They feed at night on the inner bark of the trunk in the vicinity of the root collar and the tree crown where they eat the tender bark of twigs and small branches. The eggs are placed in the adult feeding wounds in the inner bark of the root collar but often are laid in the soil as far as two inches from the tree. Larvae are found not more than twelve inches from the root collar. Larvae tunnel in the bark and cambium of the root collar region at or below the ground level completely girdling the trunk and also basal portions of the large lateral roots. Activity of the insect causes abundant resin flow, and the root collar is surrounded with pitch-infiltrated, blackened soil. A layer of pitch-infiltrated soil 2-3 inches thick may form near the feeding area.




Figures 17-23, *Hylobius* spp., spermatheca. 17—*aliradicis.* 18—*pinicola.* 19—*radicis.* 20—*warreni.* 21—*pales.* 22—*congener.* 23—*rhizophagus.*

Pupation occurs in the tunnels in the pitch-saturated soil or in enlarged cells in the bark of the root collar of the infested trees; the pupal cells are not lined with shredded wood fibers such as are characteristic of the pupal cells of the pales weevil. The weevil overwinters in the adult and larval stages and occasionally in the pupal stage. Adults that emerge late in the summer hibernate in the duff or litter under the trees. The larvae that have hibernated pupate and emerge in July and August. In Ontario, Canada, eggs laid early in the spring may produce adults in late September, but eggs laid during the remainder of the growing season produce larvae that overwinter and pupate the following July. The weevil infests primarily open-growing young pines, the larvae rather than the adults causing the severe injury, and large as well as small trees are attacked. (Finnegan, 1962; Millers, Benjamin, Warner, 1963; Warren, 1956b; Schaffner and McIntyre, 1944; Wallace, 1954.)

DISTRIBUTION[6] (fig. 46): UNITED STATES: NEW YORK: Ballston Spa, Saratoga Co.; Albany; Glen Head, Long Island; Sea Cliff. CONNECTICUT: New Canaan; Greenwich; Stamford; Old Lyme; New London. MASSACHUSETTS: Weston. MICHIGAN: Muskegon Co. MINNESOTA: Cass Lake. KENTUCKY: Booneville. WISCONSIN: Glacial Lake, Adams Co., (Brown and Young, 1955). CANADA: (Elliott and Hildahl, 1961; Sipple, MacDonald, and Rose, 1961). ONTARIO: Simcoe Co.; Lake Simcoe District; Westmeath Township, Pembroke District; McAuley Township, Parry Sound District; Essa Township; Sunnidale Township; Tosorontio Township; Tiny Township; Gibson; Balm Beach W. of Penetanguishene; W. of Barrie; Angus area. MANITOBA: Sandilands Forest Reserve, Renfrew Co.; Sault Ste. Marie.

## *Hylobius warreni* Wood
## (Fig. 31)

*Hylobius warreni* Wood, 1957. Canadian Ent. 89(1):40.

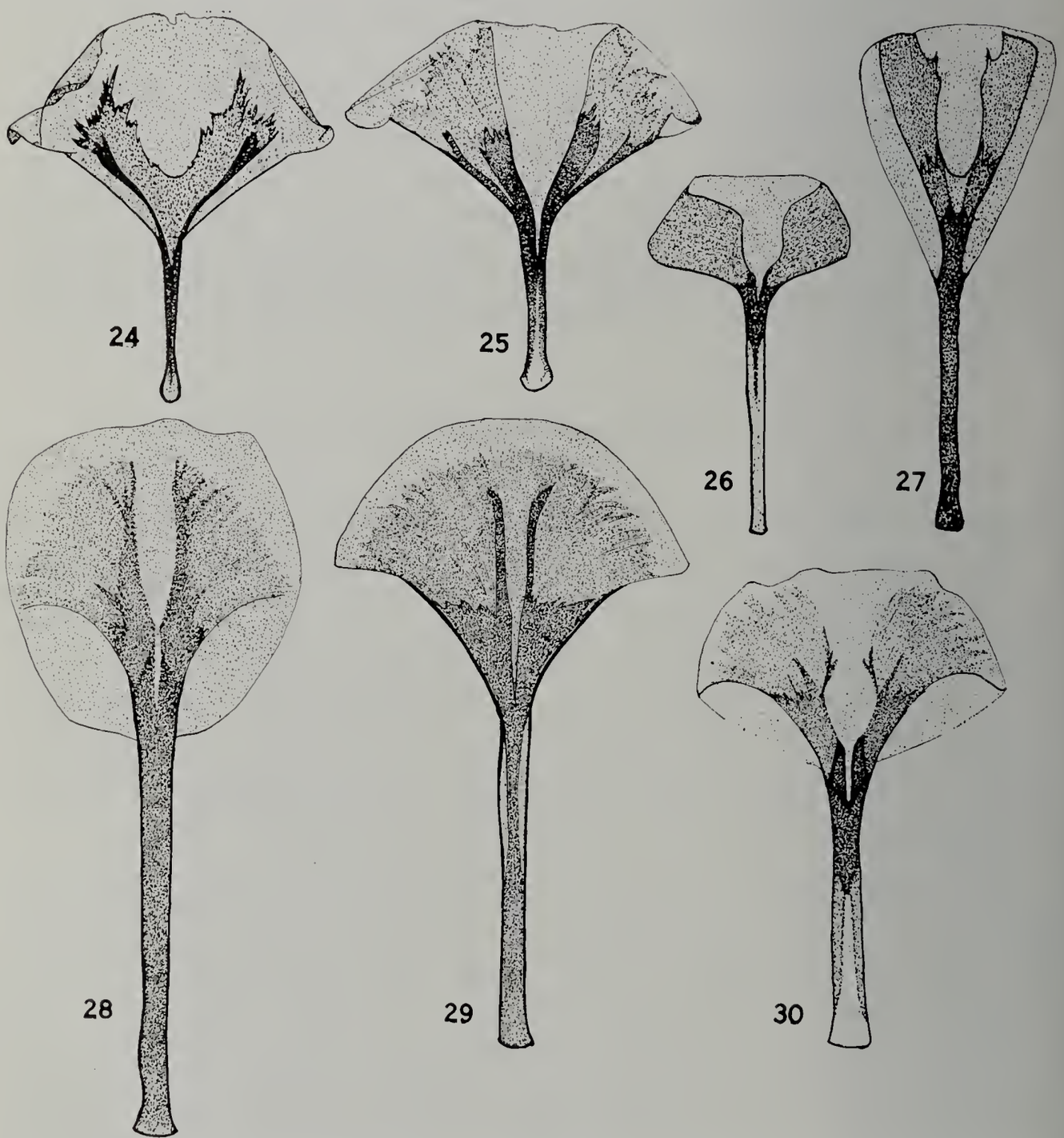
This species attacks the inner bark and cambium of the root systems of coniferous trees. Among the hosts are white spruce (*Picea glauca* (Moench) Voss), Scotch pine (*Pinus sylvestris* L.), jack pine (*P. banksiana* Lamb.), lodgepole pine (*P. contorta* Dougl.), white pine (*P. strobus* L.), red pine (*P. resinosa* Ait.), western white pine (*P. monticola* Dougl.), balsam fir (*Abies balsamea* (L.) Mill.), alpine fir (*A. lasiocarpa* (Hook) Nutt.), tamarack (eastern larch) (*Larix laricina* (DuRoi) k. Koch), Norway spruce (*Picea rubens* Sarg.) and black spruce (*P. mariana* (Mill.) B.S.P.). (Wood, 1957; Warren, 1956a; Warren, 1960).

The adults feed on the bark of small roots and twigs and on the needles of the host, but the most serious damage is caused by the larvae. The newly hatched larvae bore into the bark and along the cambium of roots and root collars of the host. This boring causes resinosis, producing noticeable exudations similar to the pitch tubes formed by scolytids. Using the exudation, a feeding larva forms a tube-like covering. This covering increases in size and hardness as the larvae grows. A number of mature larvae, feeding close together, usually cause a copious resin flow and a solid mass of hardened tubes. (Warren, 1956a)

Boring larvae may be found either on roots or root collars but appear to prefer root crotches. Small trees may be completely girdled

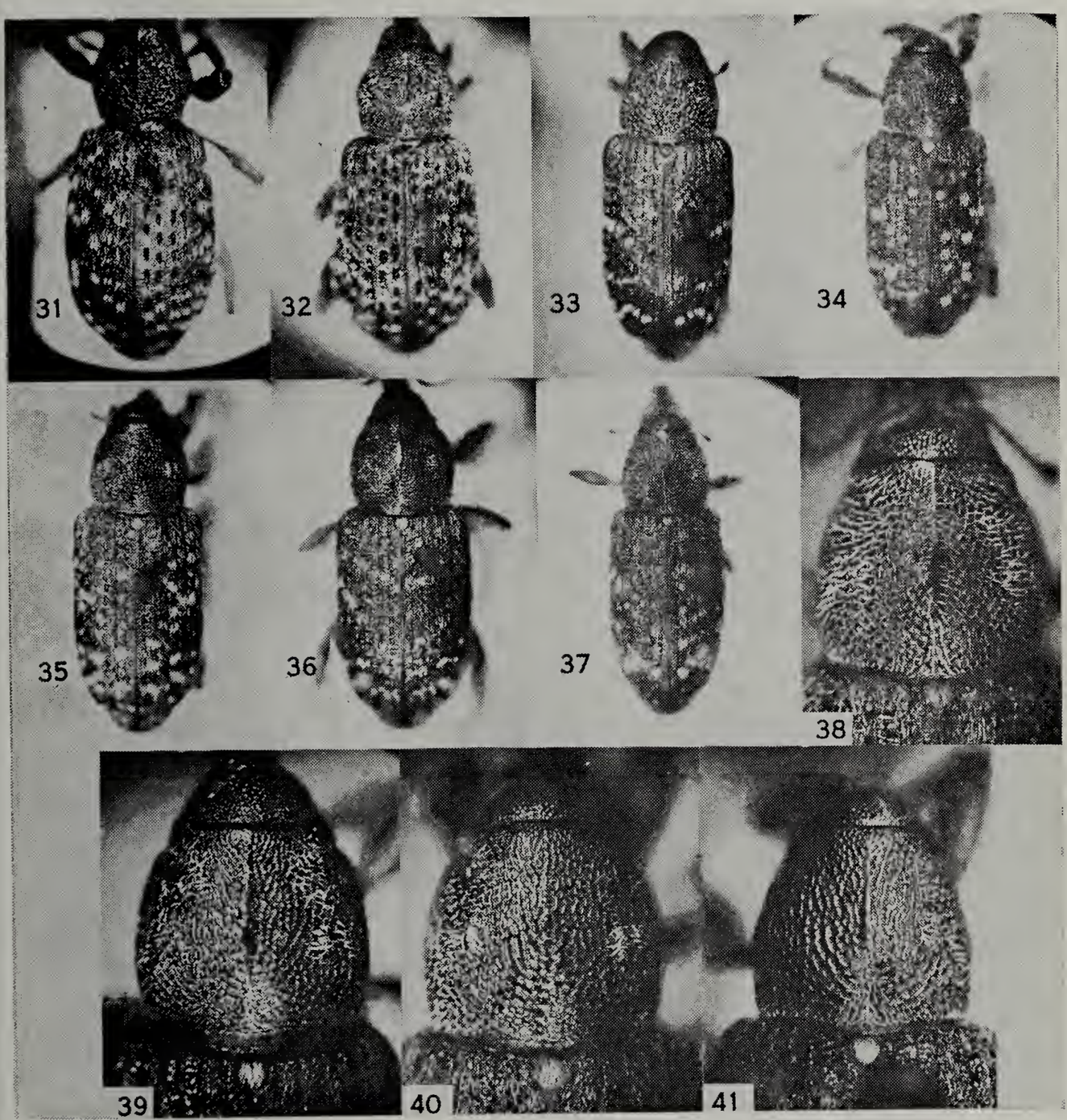
at the collar, but their main roots may be girdled or severely debarked at or adjacent to crotches. A root is considered susceptible to attack when it is more than one inch in diameter at the base. When larger roots of a tree are 4 or 5 inches in diameter at the base, the distal portions less than 2 inches in diameter are seldom damaged. Roots smaller than 2 inches on a larger tree are usually free from attack. The degree of insect damage is related to differences in the moisture content of sites. Damage is greater when the trees occur on wet or moist sites. (Warren, 1956a.)

DISTRIBUTION[6] (fig. 42): CANADA: MANITOBA: Clear Lake Trail, Riding Mountain National Park; Pine Falls; Wasagaming; Winnipeg. ALBERTA: Cold Lake; Colinton; Strachan; Cypress Hills (near Robb) (Brown, Robins, and Steven-




FIGURES 24-30, *Hylobius* spp., 8th sterna of females. 24—*warreni*. 25—*pinicola*. 26—*congener*. 27—*pales*. 28—*aliradicis*. 29—*rhizophagus*. 30—*radicis*.

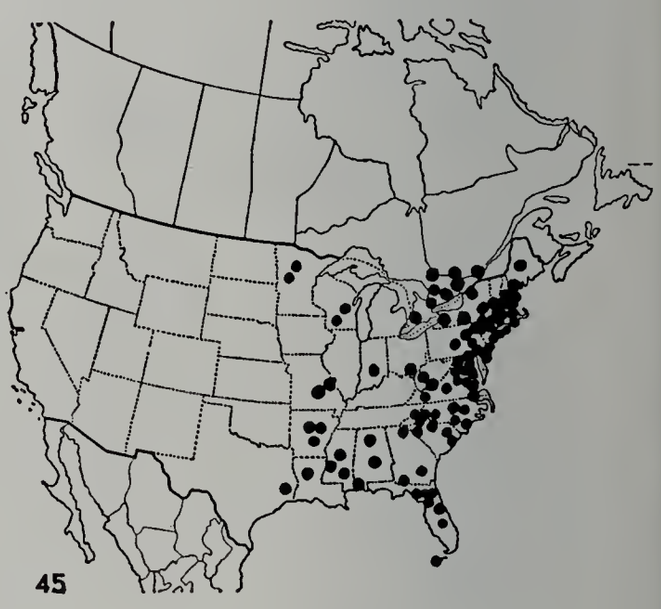
son, 1961). BRITISH COLUMBIA: Mi. 65 Alaska Highway; Golden; McLeod Meadows in Kootenay Park; Longworth; Summit Lake, Prince George; Fish Trap Creek, Barrière. NEW BRUNSWICK: Nashwaaksis. NOVA SCOTIA: Little River; Manchester; Halifax. ONTARIO: Chapeau; Cochrane; Moose Factory; Cobalt. QUEBEC: Anse St. Jean; Baie St. Paul; Cascapedia; Gaspé County; Islet Caribou; Laniel; Macamic; Maniwaki; Parke Reserve; Riviere Musquoro; Sanaur [Sanmovy]; St. Vianney; Trios Pistoles; Temiscaming; Trinity Bay, Abitibi. NEWFOUNDLAND: Burin Peninsula, Salmonier Line (prob. this species, Carroll and Parrott, 1961). UNITED STATES: MAINE: Bridgewater; Danforth; Rangeley; Seboomook; St. Francis; Sorrento; Capsuptic. MICHIGAN: Marquette; Vermilion. NEW YORK: Raybrook; Wallface Mt.; Essex Co. NORTH CAROLINA: Black Mountain.




FIGURES 31-37, *Hylobius* spp. 31—*warreni*. 32—*pinicola*. 33—*congener*. 34—*pales*. 35—*radicis*. 36—*rhizophagus*. 37—*aliradicis*.

FIGURES 38-41, *Hylobius* spp., pronotum. 38—*aliradicis*. 39—*rhizophagus*. 40—*radicis*. 41—*pales*.







FIGURES 42-48, *Hylobius* spp., distribution maps. 42—*warreni*. 43—*pinicola*. 44—*congener*. 45—*pales*. 46—*radicis*. 47—*rhizophagus*. 48—*aliradicis*.

## *Hylobius rhizophagus* Millers, Benjamin, and Warner (Figs. 36, 39)

*Hylobius rhizophagus* Millers, Benjamin, Warner, 1963. Canadian Ent. 95(1):18.

This species, the "root tip weevil," attacks the roots of jack pine (*Pinus banksiana* Lamb.), red pine (*P. resinosa* Ait.), and Scotch pine (*P. sylvestris* L.). Roots of seedlings are tunneled by larvae which leave behind tightly packed frass enclosed by the scaly sheath of the root. On larger pines, lateral roots are sometimes tunneled. Frequently, all roots in the upper foot of soil and beyond a 6 foot radius are damaged. Weevil larvae tunnel in the proximal ends of the roots, with the frass tunnels extending to the root tips. Hence the weevil is referred to by the common name, "root tip weevil." Activity of the insect results in very light resin flow, which rarely saturates soil more than an inch away. Larvae overwinter in the roots and resume feeding the following spring. Pupation takes place in early August within pupal cells constructed in the roots. Adults emerge a few weeks later and feed on the lateral branches. Root tip weevil eggs are slightly smaller than the eggs of the pine root-collar weevil. The species infests primarily closed plantations of pole-sized pines in formerly cultivated land. In advanced infestations, reproduction pines may also be infested. Larvae were reported leading to the death of 3-foot red pines planted among older jack pines. (Millers, Benjamin, 1961; Millers, Benjamin, and Warner, 1963).

DISTRIBUTION[6] (fig. 47): WISCONSIN: Lone Rock, Sauk Co.; Big Flats, Adams Co.; Wild Rose, Waushara Co.; Black River Falls, Jackson Co. MICHIGAN: Alcona Co. (larvae only, Anonymous, 1965).

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My special thanks are extended to Bernard H. Ebel, USDA Forest Science Laboratory, Athens, Georgia, for providing the reared and collected specimens of the type series of a new species and for the biological data pertaining to it. I wish to thank Dr. Edward C. Becker, Canada Department of Agriculture, Research Branch, Entomology Research Institute, Ottawa, Canada, for supplying the distribution data of the *Hylobius* specimens in the Canadian National Collection. The photographs are the special work of Dr. David G. Kissinger, Atlantic Union College, South Lancaster, Massachusetts, who so generously gave of his time during one of his visits to the U. S. National Museum to study *Apion*. My thanks go also to Mr. Elbert L. Little, Jr., Forester, Division of Dendrology and Range Forage Investigations, U. S. Forest Service, for help with the scientific and common names of the host trees.

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# BOSTRICHIDAE (COLEOPTERA) 7: A NEW XYLOTHRIPS FROM CHINA

*By* Hans Reichardt[1, 2]

Study of the Bostrichidae in the collection of the Museum of Comparative Zoology has revealed an interesting new Chinese species of the Old World genus *Xylothrips* Lesne. Very few bostrichids have been reported from China, so that this new species is an interesting addition to the family. Details of synonymy and distribution of two of the previously described species of *Xylothrips* are given by Chûjô (1958); the third, a previously described species, is the enigmatic *X. geoffroyi* (Montrouiser), known only from the type-specimen (Lesne, 1900:626) and a subsequently collected female (Chûjô, 1961:5), both from New Caledonia. Lack of knowledge of this species precludes its inclusion in the key presented below.

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[2] Number 6 in this series of articles appeared in Rev. Bras. Ent. 11:37-42.